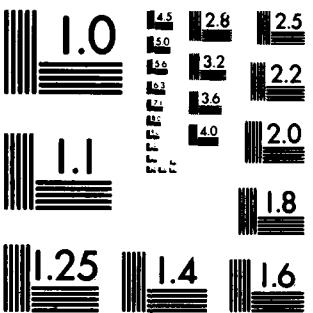


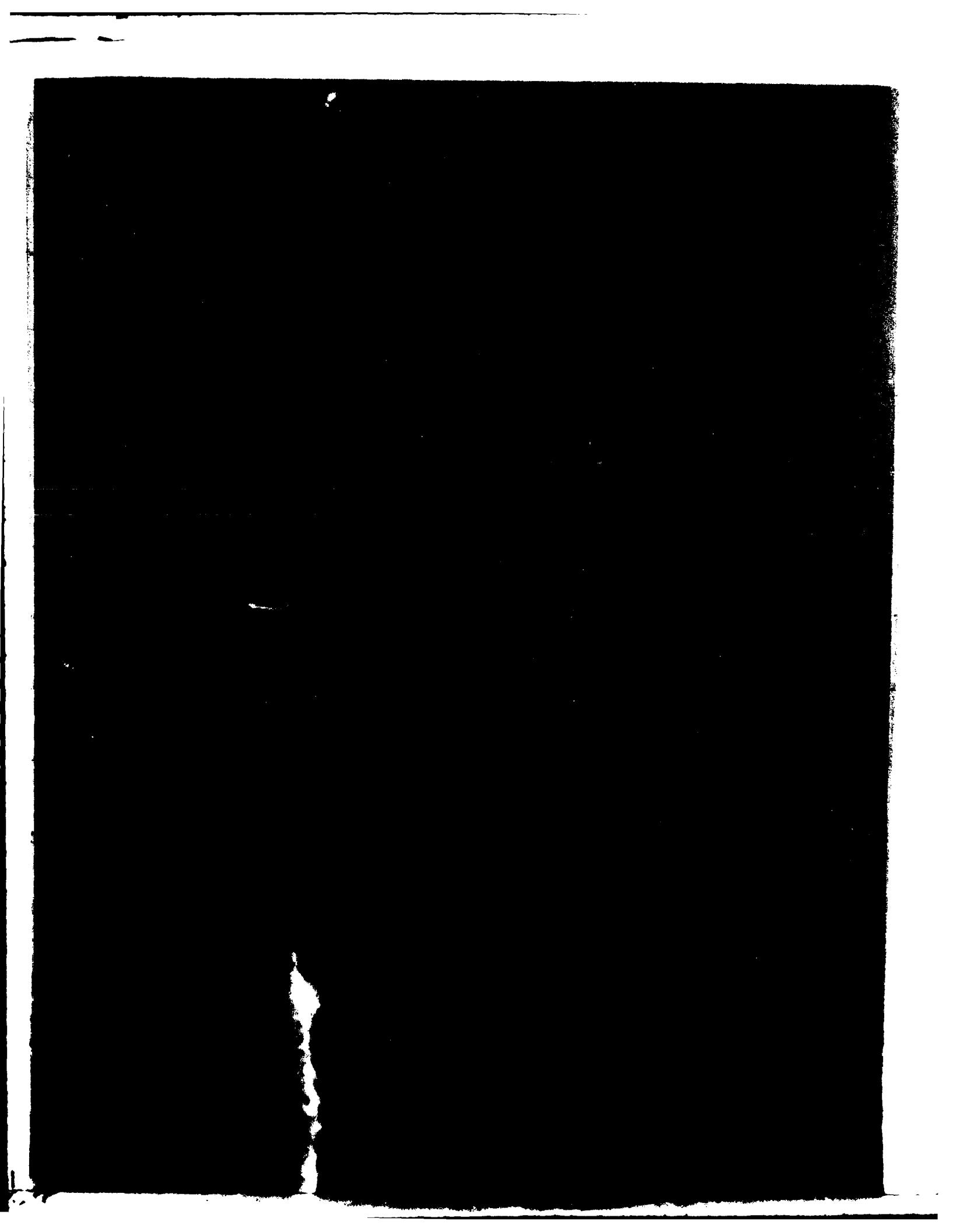
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
14 RAND REPORT NUMBER N-1453-MRAI	1. ✓ 2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) DoD Survey of Officers and Enlisted Personnel Sample Design and Selection.		5. END OF REPORT & PERIOD COVERED Interim kept
6. AUTHOR(s) W. P. Hutzler, Z. D. Doering		7. CONTRACT OR GRANT NUMBER(s) MDA903-77-C-0108
9. PERFORMING ORGANIZATION NAME AND ADDRESS The Rand Corporation 1700 Main Street Santa Monica, California 90401		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Assistant Secretary of Defense Manpower, Reserve Affairs & Logistics Washington, D. C. 20301		12. REPORT DATE February 1980
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 27
16. DISTRIBUTION STATEMENT (of this Report)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
Approved for Public Release; Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) No Restrictions		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Military Personnel Surveys Houses Medical Services Benefit Plans		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) See Reverse Side		

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SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

Since 1969, the Department of Defense has conducted large-scale surveys of military personnel at approximately two-year intervals. These surveys, administered across Services, have measured the attitudes of military personnel toward a number of DoD programs and policies. This note describes the sampling plan and selection process that Rand developed for the administration of the 1978 DoD Survey of Officers and Enlisted Personnel. Recommendations are given for the development by the Army, Navy, and Marine Corps of a sampling capability that interfaces with central personnel files and a survey capability integrated into the personnel organizations of those Services, i.e., a system similar to that of the Air Force. 29 pp. (WPH)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

N-1453-MRAL

February 1980

1978 DOD SURVEY OF OFFICERS AND ENLISTED PERSONNEL:
SAMPLE DESIGN AND SELECTION

W. P. Hutzler, Z. D. Doering

A Rand Note
prepared for the

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE/MANPOWER,
RESERVE AFFAIRS AND LOGISTICS



PREFACE

This note was prepared as part of Rand's Defense Manpower Studies Program, sponsored by the Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics)--OASD (MRA&L).

With manpower issues assuming an ever greater importance in defense planning and budgeting, this study program seeks to develop broad strategies and specific solutions for dealing with present and future defense manpower problems. The achievement of these goals requires the development of new methodologies for examining broad classes of manpower problems, as well as specific problem-oriented research. In addition to analyzing current and future manpower issues, this study program will, it is hoped, contribute to a better general understanding of the manpower problems confronting the Department of Defense.

The Rand-DoD Survey Group, an element of Rand's Defense Manpower Studies Program, has been responsible for the technical coordination of the 1978 DoD Survey of Officers and Enlisted Personnel. This note describes the sampling plan and sample selection process that Rand developed for the administration of that survey. Subsequent publications will detail the rationale, overall design, and documentation of the 1978 survey.

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SUMMARY

Since 1969, the Department of Defense has conducted large-scale surveys of military personnel at approximately two-year intervals. These surveys, administered across Services, have measured the attitudes of military personnel toward a number of DoD programs and policies. The 1978 DoD Survey of Officers and Enlisted Personnel was designed to provide the Office of the Secretary of Defense (OSD) and the military services with a comprehensive data base that can be used to make decisions about a range of personnel policies.

The 1978 survey collected two types of data: The first type will be used to monitor the impact of military personnel policies in areas (e.g., housing, medical care, and benefits) where policy formulation and budget review are the long-term responsibility of OSD and the Services. The second type of data, which will be collected only once, will be used to analyze specific topics or issues (e.g., personnel rotation policies and military compensation). The data gathered in the 1978 DoD survey will thus permit analyses of issues of specific interest to policymakers and will provide a unique description of the men and women currently in the Armed Forces.

THE SURVEY DESIGN

Because of the multiplicity of purposes it must serve and the number of questions needed to address the topics covered, the survey was designed to be administered in four questionnaire variants, that is, two questionnaires, each having one variant for officers and one for enlisted personnel. The questionnaires dealing with family economics and labor force factors were formulated to provide comprehensive information on military family income and how military personnel make decisions. Military compensation, military family income, labor force participation of household members, and the relationship of these factors to the reenlistment decisions of Service personnel were deemed sufficiently important to warrant complete coverage on one version of the survey.

The second version of the survey deals more with the quality of life in the military services. In addition, it treats specific policy issues of interest to OSD and the Services. The data collected will not only support analyses in the areas of rotation policies, equal opportunity, and assessment of personnel morale, but will also provide previously unavailable statistics on such aspects as the family military history of officers and enlisted personnel.

SAMPLE STRATIFICATION

As in all prior DoD-wide surveys, the basic stratification variable for the 1978 DoD survey is Service. Within each Service, the enlisted samples have been stratified by years of service and the officer samples by grade and sex. Finally, supplemental samples of enlisted women and blacks have been selected to allow for special analyses. The stratification plan was chosen to accommodate several aspects of the DoD continuing Service-wide survey effort. First, the structure of the 1978 DoD survey is similar to that used for the 1976 DoD survey. The similarity will enable data from the two surveys to be compared in several areas of personnel management that continue to warrant investigation, including reenlistment intention and compensation valuation. The similar stratification structures of the two surveys will also facilitate the comparison of response rates. This comparison will permit an evaluation of the impact of radical changes--namely, reliance on Service channels combined with rigorous sample accountability requirements--which have been made in survey administration. We have used the 1976 DoD survey for comparison, because it is, to our knowledge, the only one for which at least some documentation of administrative procedures and results is available.

SAMPLE DESIGN AND SELECTION

The actual sample design formulated for this survey was bounded by three factors: the need for a statistically significant number of *usable* responses in each cell of the stratification, the expected response rate of sampled individuals, and finally a budget constraint. These three factors, combined with the structure of the sample stratification and the reality of having to field four distinct questionnaires,

led us to the calculation of the target number of completed and usable questionnaires.

The Rand-DoD Survey Group, which is responsible for the technical coordination of this survey, reports to and works with the Defense Manpower Data Center (DMDC) of MRA&L. As an OSD agency, DMDC has the authority to maintain and use individual military personnel records, to request records from the Services, and to obtain information from the people in the sample. Thus, although Rand designed the questionnaires, the sample, and the detailed administrative procedures, DMDC was responsible for sampling activities, transfer of information to a survey contractor, and handling of returned questionnaires prior to processing.

Detailed instructions for selecting samples of enlisted and officer personnel to participate in the survey were coordinated through Service points-of-contact and were reviewed by the appropriate data-processing staffs.

CONCLUSIONS

The experience gained from the sample design and selection for the 1978 DoD survey has definite implications for subsequent survey efforts in OSD. First, sample design and selection procedures have to be undertaken simultaneously, with feedback between the two. Second, considerable time and resources have to be allocated to these activities, so that surveys are conducted in a timely fashion; we underestimated both time and resources by a factor of two for this survey. Finally, we would like to see the development in the Army, Navy, and Marine Corps of a sampling capability that interfaces with central personnel files and a survey capability integrated into the personnel organizations, i.e., a system similar to that of the Air Force. Access to such a capability would make routine, professional-level data collection possible at the OSD level.

ACKNOWLEDGMENTS

The sampling plan for the 1978 DoD Survey of Officers and Enlisted Personnel could not have resulted in an actual sample were it not for the guidance and work of many people.

For helping us to better understand the universe from which the samples were drawn and the procedures necessary to field the survey we thank Maj. Ray Newman, U.S. Army Military Personnel Center; LCDR Robert Holmes, U.S. Navy Bureau of Personnel; Maj. Daniel Kuhn, U.S. Marine Corps Manpower Management Information Systems Branch; and Ms. Gean Cruseturner and TSgt. Gary Fox, U.S. Air Force Manpower Personnel Center.

At the Defense Manpower Data Center, the efforts of Elsie Elster and Helen Hagan in keypunching and data processing, respectively, contributed to the implementation of the sampling plan.

We also benefited from the guidance and help of our colleagues at The Rand Corporation. David Grissmer offered numerous suggestions on the development of the sample design; Jennifer Hawes was invaluable in coordinating our activities with the Services; Corazon Francisco assisted in the sample validation; Michael Polich and Jane Sachar provided critical review of this note and suggestions for its final form. We thank Maureen David and Marie Sanchez for their diligent secretarial assistance, and Erma Packman for painstakingly editing this note.

Finally, but surely foremost, we express our admiration and gratitude to Gwen O'Neill of the Defense Manpower Data Center. Not only did she do in a matter of weeks what should have been allowed to take much longer, but her attention to detail in helping to translate this sampling plan into manipulations of the Services' personnel files cannot be commended too highly. Her patience with us and the seemingly infinite variety of "special effects" that had to be created to treat the diversity of the plan and survey procedures is gratefully acknowledged.

Any errors and omissions which remain are, of course, the responsibility of the authors.

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I. INTRODUCTION

Since 1969, the Department of Defense has conducted large-scale surveys of military personnel at approximately two-year intervals. These surveys, administered across Services, have measured the attitudes of military personnel toward a number of DoD programs and policies. The 1978 DoD Survey of Officers and Enlisted Personnel was designed to provide the Office of the Secretary of Defense (OSD) and the military services with a comprehensive data base that can be used in making decisions about a range of personnel policies.

The 1978 survey collected two types of data: The first type will be used to monitor the impact of military personnel policies in areas (e.g., housing, medical care, and benefits) where policy formulation and budget review are the long-term responsibility of OSD and the Services. Comparable data will be collected in subsequent DoD-wide personnel surveys. The second type of data, which will be collected only once, will be used to analyze specific topics or issues (e.g., personnel rotation policies and military compensation).

Thus, the data gathered in the 1978 DoD survey will permit analyses of issues of specific interest to policymakers and will provide a unique description of the men and women currently in the Armed Forces.

This note describes the sampling plan that the Rand-DoD Survey Group developed for the administration of the 1978 DoD survey. Given the multiple purposes of the survey, Rand designed this sampling plan to take into account three criteria. First, the sample sizes had to be adequate to permit in-depth analysis of specific topics. Second, the design had to be comparable to that of previous DoD-wide surveys to allow for comparative analysis of specific subjects. Third, the design had to be equally applicable to all Services to allow for comparative inter-Service analyses.

The second section describes the sampling plan in detail, including the sample stratification, sample sizes, response rate assumptions, and the final sample design. The third section discusses the quality

of the four samples selected (Army, Navy, Marine Corps, and Air Force) by way of a comparison of sample statistics and statistics of the population from which the samples were drawn. The last section discusses problems that arose in selecting the samples required in each Service.

II. THE SAMPLING PLAN

The design of the sample for the 1978 DoD survey was predicated on the need for comparability with prior surveys and the requirements imposed by planned analyses of specific topics. In addition to analytic requirements, any proposed design had to take into account two additional considerations--administrative requirements for data collection and budgetary constraints. Since the survey was being administered through Service channels, every effort was made to keep the sample size small so as to minimize the administrative burden and the amount of time that military personnel would have to spend on data collection. Budgetary constraints were reflected in the funding available for data processing of returned questionnaires. Although these constraints limited the total number of questionnaires that could be administered, the statistical significance of the results has not been compromised.

THE SURVEY DESIGN

Because of the multiplicity of purposes it must serve and the number of questions needed to address the topics covered, the survey was designed to be administered in four questionnaire variants:

- o Form 1. *1978 DoD Survey of Enlisted Personnel*, which deals primarily with economic issues, civilian employment, orientation to different reenlistment options, and retirement.
- o Form 2. *1978 DoD Survey of Enlisted Personnel*, which deals primarily with specific personnel policies, e.g., rotation experience, promotion, and the military's utilization of women.
- o Form 3. *1978 DoD Survey of Officers*, which is Form 1 adapted for officers.
- o Form 4. *1978 DoD Survey of Officers*, which is Form 2 adapted for officers.

*The survey forms will be described in a forthcoming document.

Forms 1 and 3, the questionnaires dealing with family economics and labor force factors, were formulated to provide comprehensive information on military family income and how military personnel make decisions. Military compensation, military family income, labor force participation of household members, and the relationship of these factors to the reenlistment decisions of Service personnel were deemed sufficiently important to warrant complete coverage on one version of the survey. The additional relevance of these questions to policy areas currently under consideration within the DoD, especially for enlisted personnel, required special consideration in designing the sample.

These considerations are discussed below.

Forms 2 and 4, which are more diverse than 1 and 3, deal with various aspects of the quality of life in the military services. In addition, Forms 2 and 4 treat specific policy issues of interest to OSD and the Services. The data collected will not only support analyses in the areas of rotation policies, equal opportunity, and assessment of personnel morale, but will also provide previously unavailable statistics on such aspects as the family military history of officers and enlisted personnel.

SAMPLE STRATIFICATION

As in all prior DoD-wide surveys, the basic stratification variable for the 1978 DoD survey is Service. Within each Service, the enlisted samples have been stratified by years of service and the officer samples by grade and sex. Finally, supplemental samples of enlisted women and blacks have been selected for special analyses. The nine cells resulting from the enlisted personnel stratification are shown in Table 1; the five cells in the officer samples are shown in Table 2. The stratification plan was chosen to accommodate several aspects of the DoD continuing Service-wide survey effort. First, the structure of the 1978 DoD survey is similar to that used for the 1976 DoD survey. The similarity will enable data from the two surveys to be compared in several areas of personnel management that continue to warrant investigation, including reenlistment intention and compensation valuation. The

Table 1
SAMPLE STRATIFICATION OF ENLISTED PERSONNEL

Sample Cell	Years of Service	Years to ETS ^a
1	0 to 4	≤1
2	0 to 4	>1
3	5 to 8	≤1
4	5 to 8	>1
5	9 to 12	
6	13 to 16	
7	17+	
Supplemental Sample^b		
8	Additional females	
9	Additional blacks	

^aEnlistment term of service.

^bBoth females and blacks are included in the first seven sample cells. Supplemental samples were drawn to ensure a statistically significant number of them for specific analyses.

Table 2
SAMPLE STRATIFICATION OF OFFICER PERSONNEL

Sample Cell	Sex	Grade
1	Male	0-1, 0-2
2	Male	0-3
3	Male	0-4
4	Male	0-5, 0-6
5	Female	0-1 to 0-6

similar stratification structures of the two surveys will also facilitate the comparison of response rates. This comparison will permit an evaluation of the impact of radical changes--namely, reliance on Service channels combined with rigorous sample accountability requirements--which have been made in survey administration. We have used the 1976 DoD survey for comparison purposes, because it is, to our knowledge, the only one for which at least some documentation of administrative procedures and results is available.

The 1976 and 1978 sample stratification of officers differ only in the creation in 1978 of a sample cell for women officers in pay grades O-1 to O-6. In prior surveys, officers were selected only on the basis of pay grade, that is, on the basis of the pay grades in Table 2, but with no separate accounting of males and females. The current structure aims at obtaining a significant number of responses from women on pertinent issues arising from their increased employment by the Services. In addition, the comparative analysis of the specifically female experience required a larger female sample. However, since the stratification by officer grades remains unchanged from prior surveys, data for all officers can still be compared by weighting and tabulating in one of the first four cells, according to pay grade, the responses received from women in the fifth officer cell.

The partitioning of the enlisted sample for this survey diverges from that used in 1976 owing to the coverage in 1978 of a large number of topical issues, e.g., compensation, rotation policies, and equal opportunity. The inclusion of questions on some of these issues necessitated the creation of separate cells for supplemental sampling of females and blacks because of their generally low representation in the military population. The need for the additional sampling of these two groups, coupled with a budget constraint, also meant that the extensive stratification by Enlistment Terms of Service (ETS) used in 1976 could no longer be maintained. However, stratification by ETS could not be abandoned altogether, because of the special requirements for analysis of current reenlistment intent among first- and second-term personnel and the need for comparative analysis of this data.

Thus, as Table 1 indicates, the first two years-of-service (YOS) groups (that is, the first four cells) include a division by both YOS and time remaining until the end of the ETS and, aside from a slight variation in the endpoints of the YOS categories, the first four cells of the 1976 and 1978 sampling designs are the same. Thus the responses to like questions on these two surveys can easily be compared since each of the enlisted questionnaire variants (Forms 1 and 2) asks a respondent to record the amount of time he has spent in the Service and the time remaining to his ETS. Although the endpoints of the time intervals used for cells 5, 6, and 7 in the enlisted sample (Table 1) also differ slightly from those used in 1976, data from the two surveys remain comparable.

SAMPLE DESIGN

The actual sample design formulated for this survey was bounded by three factors: the need for a statistically significant number of (usable) responses in each cell of the stratification, the expected response rate of sampled individuals, and finally a budget constraint. These three factors, combined with the structure of the sample stratification described above and the reality of having to field four distinct questionnaires, led us to the calculation of the target number of completed and usable questionnaires shown in Tables 3 and 4.

The design requirement for 1000 usable responses from enlisted personnel in cells 1 and 3 (Table 3) assigned the economic variant (Form 1) stemmed from the need for concentrated analyses of specific issues affecting first- and second-term personnel. The supplemental samples of enlisted females and blacks (cells 8 and 9) were designed to produce a total of 500 usable responses in each Service for each of these groups. Note that female and black respondents to the questionnaires cannot be classified as to their selection in either the primary or supplemental samples. Thus, only the first seven cells can be used to stratify the enlisted respondents, and analyses of respondent questionnaires falling within or across these first seven cells must recognize the oversampling of enlisted females and blacks. Oversampling of enlisted blacks in the Army was unnecessary because their expected number in the primary sample (cells 1-7) exceeds 500.

Table 3
TARGET NUMBER OF RESPONSES FOR ENLISTED PERSONNEL^a
(each variant)

Sample Cell	Years of Service	Years to ETS	Army	Navy	Marine Corps	Air Force
1	0 to 4	≤ 1	1000 ^b	1000 ^b	1000 ^b	1000 ^b
2	0 to 4	> 1	500 ^c	500 ^c	500 ^c	500 ^c
3	5 to 8	≤ 1	1000 ^b	1000 ^b	1000 ^b	1000 ^b
4	5 to 8	> 1	500 ^c	500 ^c	500 ^c	500 ^c
5	9 to 12		500	500	500	500
6	13 to 16		500	500	500	500
7	17+		500	500	500	500
Supplemental Sample						
8	Females		280	370	370	250
9	Blacks		(d)	320	95	110
	Total		4780 ^b	5190 ^b	4965 ^b	4860 ^b
			3780 ^c	4190 ^c	3965 ^c	3860 ^c

^aTable entries represent the numbers of completed, usable questionnaires desired (Form 1 and Form 2).

^bForm 1.

^cForm 2.

^dEnough blacks could be expected in the Army primary sample in cells 1-7 that a supplemental sampling was unnecessary.

The target number of usable officer responses by Service (Table 4) shows a uniform distribution across all five cells, except in the Marine Corps. Since at the time our sample was selected the Marine Corps had only about 400 female officers, we decided to include females in the first four Marine officer cells in the sample. They occur in the sample in proportion to their numbers in the Marine Corps population.

RESPONSE RATE ASSUMPTIONS

The actual number of personnel selected to participate in the survey was derived by applying assumed expected response rates to the sample design presented in Tables 3 and 4. Two rates of primary

Table 4
TARGET NUMBER OF RESPONSES FOR OFFICER PERSONNEL
(each variant)

Sample Cell	Sex	Grade	Army	Navy	Marine Corps	Air Force
1	Male	0-1, 0-2	500	500	500	500
2	Male	0-3	500	500	500	500
3	Male	0-4	500	500	500	500
4	Male	0-5, 0-6	500	500	500	500
5	Female	0-1 to 0-6	500	500	(a)	500
		Total	2500	2500	2000	2500

^aFemales are included in the first four cells in proportion to their numbers in the Marine Corps population.

importance were used to calculate the final size of the survey sample. The first was the response rate itself, or the percentage of issued questionnaires that were expected to be completed and returned by survey participants. This rate, multiplied by the number of questionnaires issued, provided an estimate of the number of questionnaires that must pass through a first round of quality control editing.

The second rate, and the one that is more directly applicable in determining sample sizes, is the percentage of issued questionnaires that are returned and that pass successfully through several stages of editing. These are the questionnaires that finally become available for analysis. By dividing the proportion of completed, usable questionnaires into the target sample, we obtained the number of questionnaires that had to be fielded to provide the appropriate number for analysis.

In the presence of a budget constraint, the costs of fielding the survey (printing and mailing questionnaires and related material, editing returns, and storing responses on magnetic tape) is determined by considering both the total number of questionnaires to be fielded and the number to be processed. This required an analysis using both of the rates described above.

The response rates and percentage of usable questionnaires that were assumed for the current survey are presented in Tables 5 and 6. They were derived in part from the corresponding rates experienced in prior DoD surveys (primarily the 1976 survey). The 1976 rates could not be used directly, because the administrative procedures developed

Table 5
RESPONSE RATE ASSUMPTION FOR ENLISTED PERSONNEL^a

Sample Cell	Years of Service	Years to ETS	Army	Navy	Marine Corps	Air Force
1	0 to 4	≤ 1	41/40	47/46	45/43	65/64
2	0 to 4	> 1	50/49	50/49	44/43	73/72
3	5 to 8	≤ 1	54/53	51/50	50/48	70/69
4	5 to 8	> 1	69/67	78/76	60/59	74/73
5	9 to 12		70/69	71/70	58/56	76/75
6	13 to 16		69/68	66/64	56/54	77/76
7	17+		69/68	66/64	56/54	77/76
Supplemental Sample						
8	Females		54/52	51/49	51/49	70/68
9	Blacks		35/33	35/33	35/33	48/46

^aTable entries represent expected response rates/expected usable proportion of issued questionnaires, both in percent.

Table 6
RESPONSE RATE ASSUMPTIONS FOR OFFICERS^a

Sample Cell	Sex	Grade	Army	Navy	Marine Corps	Air Force
1	Male	O-1, O-2	71/70	60/59	50/48	70/69
2	Male	O-3	78/77	72/70	55/53	77/75
3	Male	O-4	78/76	75/73	60/58	70/69
4	Male	O-5, O-6	84/83	71/69	65/63	88/87
5	Female	O-1 to O-6	76/75	68/67	(b)	73/72

^aTable entries represent expected response rates/expected usable proportion of issued questionnaires, both in percent.

^b

Females are included in the first four cells of the sampling design.

for the 1978 survey differed from those used previously. The historical rates were thus adjusted to reflect those differences, as well as estimates of response rates received from the Services.

THE SAMPLING PLAN

The sampling plan developed for the 1978 DoD survey calls for the distribution of approximately 90,000 questionnaires, 62,800 to enlisted personnel (Forms 1 and 2) and 27,200 to officers (Forms 3 and 4).

Table 7 summarizes the distribution of these questionnaires by Service. The detailed distribution of questionnaires by cell is shown in Tables 8 and 9 for enlisted and officer personnel, respectively. Also shown in Tables 8 and 9 are the proportion of the cell population represented by the sample in each cell, along with the selection frequency for each of the cells. The selection frequency is simply the reciprocal of the population percentage sampled in each cell and, thus, the frequency with which individuals in a particular cell are represented in the sample. For example, from Table 8 we see that in the Army's first cell, approximately 10 out of every 275 people in that cell population will fall into the sample. The figures given for the supplemental sample of enlisted females and blacks are calculated with respect to the cell population remaining after the primary sample (cells 1-7) had been selected.

Table 7

SUMMARY OF SAMPLING PLAN FOR 1978 DOD SURVEY OF OFFICER AND ENLISTED PERSONNEL

Category	Army	Navy	Marine Corps	Air Force	Total DoD
Enlisted	15,590	17,620	17,170	12,460	62,840
Officer	6,585	7,440	6,415	6,775	27,215
Total	22,175	25,060	23,585	29,235	90,055

Table 8
SAMPLING PLAN FOR ENLISTED PERSONNEL

Sample Cell	Years of Service	Years to ETS	Percent of Selection Group Frequency Number			Percent of Selection Group Frequency		
			Army			Navy		
1	0 to 4	≤ 1	3750	3.6	27.5	3260	6.1	16.5
2	0 to 4	> 1	2040	0.6	157.8	2040	0.9	105.6
3	5 to 8	≤ 1	2830	11.1	9.0	3000	19.6	5.1
4	5 to 8	> 1	1495	1.7	59.6	1315	2.1	46.5
5	9 to 12		1450	3.0	33.9	1430	3.9	25.9
6	13 to 16		1470	4.7	21.2	1565	5.0	20.1
7	17+		1470	2.9	34.4	1565	3.4	29.4
Supplemental Sample								
8	Females		1085	2.4	41.7	1520	8.1	12.3
9	Blacks		(610)	---	---	1925	4.9	20.2
	Total		15,590	2.3	43.6	17,620	3.8	26.2
<hr/>								
			Marine Corps			Air Force		
1	0 to 4	≤ 1	3380	13.1	7.6	2345	5.7	17.7
2	0 to 4	> 1	2315	2.2	44.4	1390	0.7	127.3
3	5 to 8	≤ 1	2635	59.4	1.7	2175	16.1	6.2
4	5 to 8	> 1	1650	9.3	10.7	1370	1.9	51.6
5	9 to 12		1695	18.6	5.4	1335	2.4	41.0
6	13 to 16		1655	39.6	2.5	1315	3.5	28.9
7	17+		1755	19.7	5.1	1315	1.8	56.7
Supplemental Sample								
8	Females		1525	46.9	2.1	730	2.2	46.4
9	Blacks		560	2.0	50.0	485	6.7	15.0
	Total		17,170	9.9	10.1	12,460	2.7	37.7

Based on this sampling plan, 35,967 enlisted personnel (including 8750 Army, 9640 Navy, 8715 Marine Corps, and 8860 Air Force) and 18,920 officers (including 5080 Army, 5120 Navy, 3625 Marine Corps, and 5085 Air Force) are expected to return completed questionnaires. The overall response rate was expected to be 57 percent for the enlisted portion of the survey and 70 percent for the officer portion.

Table 9
SAMPLING PLAN FOR OFFICER PERSONNEL

Sex	Grade	Number	Percent of Selection		Percent of Selection	
			Group	Frequency	Group	Frequency
Army						
Male	0-1, 0-2	1430	7.6	13.1	1695	10.1
Male	0-3	1300	4.6	21.7	1430	8.5
Male	0-4	1315	8.2	12.3	1370	11.6
Male	0-5, 0-6	1205	7.8	12.8	1450	13.3
Female	0-1 to 0-6	1335	23.6	4.2	1495	39.6
Total		6585	7.8	12.8	7440	12.4
Navy						
Marine Corps						
Male	0-1, 0-2	1960	25.9	4.0	1450	8.6
Male	0-3	1705	36.5	2.7	1335	3.5
Male	0-4	1465	52.0	1.9	1450	8.1
Male	0-5, 0-6	1285	61.0	1.6	1150	6.7
Female	0-1 to 0-6	(a)	(a)	(a)	1390	25.8
Total		6415	36.7	2.7	6775	7.1
Air Force						

^aFemales are included in the first four cells of the sampling design.

SAMPLE SELECTION

The Rand-DoD Survey Group, which is responsible for the technical coordination of this survey, reports to and works with the Defense Manpower Data Center (DMDC), MRA&L. As an OSD agency, DMDC has the authority to maintain and use individual military personnel records, to request records from the Services, and to obtain information from people in the sample. Thus, although Rand designed the questionnaires, the sample, and the detailed administrative procedures, DMDC was responsible for sampling activities, transfer of information to a survey contractor, and handling of returned questionnaires prior to processing.

Detailed instructions for selecting samples of enlisted and officer personnel to participate in the survey were coordinated through Service points-of-contact and were reviewed by the appropriate data-processing

staffs. To meet the fieldwork schedule and yet have current information, DMDC requested that the Services provide their samples on magnetic tape by mid-October 1978. These tapes were to be based on personnel records current as of 30 September 1978.

The Survey Group assumed that each Service would select its own samples based on the figures shown in Tables 8 and 9. The Air Force and Marine Corps complied, and Navy could have complied, but the Army was unable to meet the schedule. For reasons explained below, DMDC selected both the Army and Navy samples.

The Survey Group provided guidelines to the Services on the size of the cells and selection of the samples. The required number of enlisted personnel in cells 1 to 7 were to be chosen randomly from the total enlisted population in each cell. For the cell 8 supplementary sample, females were to be chosen randomly from among those not previously selected for one of the first seven cells. Except in the Army, where no additional candidates were necessary to fill cell 9, the required number of blacks in the supplemental sample were to be chosen randomly from among all blacks not already in one of the first eight cells.

Instructions for the selection of officers were written so as to provide a sample according to the distributions given in Table 9. The Marine Corps presented the only special situation. The sole stratification was to be by pay grade, with both males and females to be selected randomly from the entire officer population for a given grade level.

The Services were instructed to gather samples from their master personnel files and to provide these to the Defense Manpower Data Center by mid-October 1978. Since three months would elapse between sample selection and the actual data collection, the Services were instructed also to exclude enlisted personnel and officers whose ETS date occurred on or prior to 31 January 1979. The exclusion of this group from the sample would increase the overall response rates by eliminating all non-response due to ETS separation and at least some of that due to permanent changes of station in conjunction with reenlistment.

The Navy, Air Force, and Marine Corps provided the required samples, along with selected demographic and locational information

for each individual. The Army Military Personnel Center (MILPERCEN) could not meet the schedule for the selection of a sample from its central personnel files. As a result, a population tape was provided to DMDC for the actual sample selection. The Survey Group decided also to request a population tape from the Navy and to have DMDC select the sample. We were at that time considering the clustering of Navy units prior to selection to simplify administration of the questionnaire in the fleet. Although after discussions with Department of the Navy personnel we decided against clustering, DMDC selected the Navy sample.

The Air Force and Marine Corps selected their respective samples using computerized procedures. The procedures have been thoroughly tested and have been used repeatedly for Service-specific surveys. DMDC selected the Army and Navy samples by random selection of end-digits for individual social security numbers. The actual samples derived for each Service are displayed in Tables 10 and 11. The total number of questionnaires fielded (by form) is shown in Table 12. The Service totals in Table 12 differ from those shown in Tables 10 and 11 by the number of individuals who had to be dropped from the sample because of inconsistencies in their personnel records which could not be expeditiously resolved.

Table 10
NUMBER OF ENLISTED PERSONNEL SAMPLED

Sample Cell ^a	Years of Service	Years to ETS	Army	Navy	Marine Corps	Air Force
1	0 to 4	≤ 1	4360	3756	3484	2549
2	0 to 4	> 1	3973	4763	3958	1792
3	5 to 8	≤ 1	3006	3133	2326	2335
4	5 to 8	> 1	1974	2164	1783	1578
5	9 to 12		1625	1616	1785	1423
6	13 to 16		1625	1733	1567	1398
7	17+		1537	1706	1573	1385
Total			18,100	18,871	16,476	12,460

^aCells 8 and 9 are dispersed in the table by YOS and ETS.

Table 11
NUMBER OF OFFICERS SAMPLED

Sample Cell	Sex	Grade	Army	Navy	Marine Corps	Air Force
1	Male	0-1, 0-2	1475	1692	2016	1450
2	Male	0-3	1282	1490	1721	1335
3	Male	0-4	1419	1406	1330	1450
4	Male	0-5, 0-6	1170	1558	1099	1150
5	Female	0-1 to 0-6	1368	1604	(a)	1390
Total			6714	7750	6166	6775

^aFemales are included in cells 1-4.

Table 12
NUMBER OF QUESTIONNAIRES FIELDED
IN THE 1978 DOD SURVEY

Form	Army	Navy	Marine Corps	Air Force	Total
1	9,994	10,584	9,384	7,045	37,007
2	7,853	8,286	7,092	5,415	28,646
Enlisted					
Total	(17,847)	(18,870)	(16,476)	(12,460)	(65,653)
3	3,165	3,806	3,066	3,388	13,425
4	3,166	3,806	3,067	3,387	13,426
Officer					
Total	(6,331)	(7,612)	(6,133)	(6,775)	(26,851)
Total	24,178	26,482	22,609	19,235	92,504

The questionnaire forms were assigned in a straightforward manner. In each Service, every second officer on the sample computer file was labeled to receive Form 3; the other officers were labeled to receive Form 4. The same procedure was applied to enlisted personnel in cells 2 and 4 through 7 for the assignment of Forms 1 and 2. For those in cells 1 and 3, every third person was assigned to receive Form 2, with the remaining two-thirds assigned Form 1. Before the actual assignment

of variants to the sampled enlisted personnel was made, however, individuals in cells 8 and 9 (supplemental females and blacks) were distributed among the first seven cells according to their length of service and, in the case of cells 1 through 4, according to their ETS date.

III. THE QUALITY OF THE SAMPLE

To determine the quality, i.e., randomness, of the samples selected, we performed statistical tests on a number of demographic characteristics, comparing the characteristics of the samples with the corresponding population from which it was drawn. The results of that analysis are reported below. A second set of comparisons will be made when the survey questionnaires are returned from the field. That analysis will indicate the representativeness of the usable responses to the survey and will identify subgroups of personnel who returned questionnaires disproportionately. The data provided here can only show the randomness of the respective samples at the initiation of the fieldwork.

The following demographic characteristics were used to test the randomness of the survey sample:

1. Age
2. Race
3. Sex
4. Pay grade
5. Marital status
6. Number of dependents
7. Total Active Federal Military Services (TAFMS)
8. Armed Forces Qualification Test Score.

Tables 13 through 16 summarize the results of the tests, by Service. The tests identify cells in which there is a statistically significant (at the 5 percent level) difference between the selected sample and the population. In no Service, however, did these differences appear for more than a few of the characteristics considered for each cell, and in most cases these differences are not significant at the 1 percent level. Not all of the results for each Service are included in these tables, but the "worst case" characteristics detected are reported for each Service group. In addition, because of limitations

Table 13
REPRESENTATIVENESS OF ARMY SAMPLE

Demographic Characteristics	Sample Cell						
	1	2	3	4	5	6	7
Officers							
Marital status	χ^2	6.52 ^a	1.78	4.88	0.01	4.9	
	d.f.	2	2	2	1	2	
TAFMS	χ^2	5.78	27.31	60.49 ^a	34.82 ^a	40.34 ^a	
	d.f.	9	18	20	22	19	
Enlisted							
Marital status	χ^2	0.01	0.12	1.31	0.23	4.38 ^a	1.84
	d.f.	1	1	1	1	1	1
Race	χ^2	8.49 ^a	6.55 ^a	3.98	0.95	0.24	0.83
	d.f.	2	2	2	2	2	2
Pay grade	χ^2	29.36 ^a	6.00	3.88	5.48	1.39	2.00
	d.f.	4	4	4	3	3	3
No. of dependents	χ^2	4.07	20.59 ^a	7.87	10.15	15.35 ^a	12.03 ^a
	d.f.	5	5	5	5	5	5

^aSignificant at the 5 percent level.

on time and programming resources, not all of the characteristics listed above were tested in every cell for each Service. Testing was especially limited for the enlisted Air Force sample. That Service, did, however, check its sample independently.

In addition to testing the demographic characteristics listed above, we also checked the samples against the populations for the proportion of people stationed overseas. This distribution is especially important, since several planned major analyses address the experiential differences between military personnel in CONUS and overseas. In each Service, the checks indicated that the geographic distributions of the samples matched those of the population to within 0.5 percent.

Table 14
REPRESENTATIVENESS OF NAVY SAMPLE

Demographic Characteristics	Sample Cell						
	1	2	3	4	5	6	7
Officers							
Marital status	χ^2 d.f.	0.01 1	0.63 1	0.36 1	0.58 1	0.03 1	
No. of dependents	χ^2 d.f.	1.19 5	6.10 6	2.20 7	5.01 8	1.47 4	
TAFMS	χ^2 d.f.	18.05 20	26.89 24	25.86 27	25.20 24	14.78 23	
Enlisted							
Age	χ^2 d.f.	19.27 ^a 10	93.91 ^a 11	10.82 14	16.48 12	17.91 16	17.40 16
Pay grade	χ^2 d.f.	3.66 5	19.91 ^a 4	5.08 5	6.63 5	9.82 5	12.70 ^a 6
No. of dependents	χ^2 d.f.	7.95 4	7.48 4	9.13 6	17.47 ^a 6	8.46 6	4.45 7
Marital status	χ^2 d.f.	2.05 1	0.32 1	1.43 1	11.47 ^a 1	1.62 1	1.31 1
							0.63 1

^aSignificant at the 5 percent level.

Table 15
REPRESENTATIVENESS OF MARINE CORPS SAMPLE

Demographic Characteristics	Sample Cell						
	1	2	3	4	5	6	7
Officers							
TAFMS	χ^2	273.78 ^a	298.99 ^a	72.19 ^a	120.89 ^a	14.75	
	d.f.	16	23	17	15	12	
Race	χ^2	8.82 ^a	7.27 ^a	0.09	--	2.05	
	d.f.	2	2	1	--	1	
Marital status	χ^2	33.99 ^a	14.41 ^a	0.14	9.11 ^a	0.93	
	d.f.	2	2	2	2	2	
Enlisted							
Race	χ^2	5.07	128.37 ^a	2.13	2.80	4.83	0.22 23.50 ^a
	d.f.	2	2	2	2	2	2 2
Marital status	χ^2	3.82	4.73	12.93 ^a	0.62	0.27	33.67 ^a 0.13
	d.f.	1	1	1	1	1	1 1
Pay grade	χ^2	643.99 ^a	48.60 ^a	18.15 ^a	3.36	5.37	15.76 ^a 5.49
	d.f.	5	5	6	5	4	4 3

*Significant at the 5 percent level.

Table 16
REPRESENTATIVENESS OF AIR FORCE SAMPLE

Demographic Characteristics	Sample Cell						
	1	2	3	4	5	6	7
Officers							
No. of dependents	χ^2	13.19 ^a	5.08	17.28 ^a	3.32	5.59	
	d.f.	5	6	7	8	3	
Race	χ^2	24.49 ^a	1.88	6.67 ^a	8.10		
	d.f.	2	2	2	2		
Marital status	χ^2	0.01	1.01	0.0	2.48	2.78	
	d.f.	1	1	1	1	1	

^aSignificant at the 5 percent level.

IV. SAMPLE-RELATED PROBLEMS AND ISSUES

In selecting the sample for this survey, we encountered in each Service a number of problems that have implications for survey research in the military. Many of these problems stem from organizational differences between the Services; others, from differences in the way the Services maintain their personnel files. DMDC will report in detail on the extent to which the latter group of problems necessitated special programming considerations. Here we will summarize only the problems encountered while producing the data sets used in the final assembly and mailing stages of this survey, with emphasis on the problems generated by organizational differences.

One of the earliest issues was the choice of the source for sample selection, i.e., whether to use central personnel files or local (base or installation) files. The decision to use central files would mean that all of the preparatory work for data collection would be done independently of the individual or organization conducting the field-work. In this case, DMDC would either receive or prepare sample files from Service central files, undertake the necessary transformations, assign questionnaire variants to individuals, prepare sample rosters for use by Service administrative units, and send tapes to a survey contractor. The contractor would prepare individual survey packets with printed address labels, assemble the packets into predesignated aggregates, and mail the survey materials to the administrative units.

Even though we tried to make the criteria developed for sample selection sensitive to the time lag between central selection and fieldwork, this approach has serious disadvantages. First, although the central files, dated 30 September 1978, from which the samples were selected probably reflected the composition of the Services accurately, they were not completely current with respect to the location of individuals. In most Services, there is a lag between the reporting of changes at the local level and their recording centrally. Most seriously, central sample selection has no built-in

mechanism for detecting changes that occur between selection and fieldwork in time for corrective measures to be taken. Although we anticipated that most of the Summer and Fall personnel transfers would have taken place by the time the sample was selected, some undoubtedly took place in the period between 1 October 1978 and the mid-January 1979 mailing date. The sample accounting procedures will provide information about respondents who transferred during that period. However, we expect lower response rates from them, since they will receive forwarded questionnaires, than from respondents within a reporting survey jurisdiction. Individuals with ETS on or before 31 January 1978 also create problems because of the time lag caused by central selection. By eliminating the latter group from sample selection, however, we lose information from individuals who have made a very recent reenlistment decision.

An alternative sampling method involves selection at the local level. If done immediately before the start of data collection, this method would eliminate most of the problems associated with the location and status of individuals. Under this scheme, local jurisdictions would be assigned a quota sample and would be provided with guidelines both for sample selection based on the stratification variables and for the assignment of questionnaire variants. Bulk shipments of survey materials would be sent to the appropriate survey jurisdictions. The returned materials would also include, for purposes of checking sample quality and performing a response bias analysis, locally produced sample rosters and an accounting of the participation status of each selected individual.

In exploring this option, we found that several organizational problems in the Services precluded its use. First, except for the Air Force, the Services do not have the administrative capabilities to survey the total population and to interface automatically with local or regional automated personnel file systems. Even if such interfaces could have been established for this survey, we felt that the overall quality of the sample and our ability to account for all aspects of the fieldwork would have been seriously jeopardized. To implement such

a system, we would have had to cluster the Navy and possibly the Marine Corps samples to control for the population dispersion.

This option was seriously explored for the Army, because its central files do not provide information about the appropriate survey jurisdiction to which individuals should be assigned. Thus, although the Army has a capability to administer surveys through the Personnel Survey Control Officers (PSCOs), the latter are restricted to the selection of samples at the local level. We found, however, that the sampling capability of the PSCOs was limited to selection based on SSNs, pay grade, and sex; more complicated stratification, by, for example, time to ETS, was not possible. Most important, there was no way to guarantee that we would receive sample rosters with sufficient information on them to enable us to reconstruct the samples using central files so as to analyze the sample for bias. Although central sampling presented the greatest problems in the Army, we judged that solving them was preferable to the unknowns which would result from decentralized sampling.

The Air Force, for two primary reasons, presented the fewest problems in sample selection and the preparation of personnel data for survey administration. First, the Air Force is the only Service that has routine capabilities for survey sample selection which can easily interface with centrally maintained and completely automated personnel files. Second, it is the only Service with a well-developed infrastructure for survey administration which is part of the personnel system. In being able to use that existing structure, namely survey administration through Consolidated Base Personnel Officers (CBPOs), we avoided several steps required for processing the samples of the other Services. Most important, each sample record contained a code assigning the individual to a unique CBPO.

Because the Navy, for instance, has no unit formally responsible for survey design and administration, we had to analyze the selected sample for location of personnel before we could decide on how to administer the survey. The agreed-upon plan, administration through commanding officers, meant that several address files (both individual

and unit) had to be matched to our sample so as to provide appropriate addresses for survey distribution. Although Navy personnel were extremely cooperative in supplying the necessary information, the additional processing was both costly and time-consuming.

Procedures for administering the survey in the Marine Corps, i.e., through the commands, were agreed upon more quickly than for the Navy, and we were able to obtain timely respondent and locational data. A number of problems involving the use of the addresses of Marine Corps Command and Reporting Units required additional processing by DMDC. However, these relatively minor problems did not substantially delay the survey schedule.

For both the Navy and the Marine Corps, questions of how best to select the survey sample and administer the survey derived from the geographic distribution of their personnel and the assignment of personnel to sea duty. The special problems created by the dispersion of personnel could be systematically resolved if the Department of the Navy were to establish a survey capability encompassing both organizations.

The Army presented the most severe and most time-consuming sample-related difficulties. The Army's PSCO organization is most suited for surveys administered to individuals selected at the local level. Although the use of PSCOs by the Army is analogous to the use of CBPOs by the Air Force, the Army does not maintain a means of linking individuals to PSCOs via data contained in master personnel files maintained by MILPERCEN. DMDC faced a major task in creating such a linkage, so as to use the PSCOs as points at which to consolidate administration of the survey. This problem substantially delayed the processing of the Army sample and necessitated several time-consuming requests for data held by MILPERCEN, as well as verification letters and telephone calls to PSCOs.

The main difficulty in assigning individuals to PSCOs is that the current network of PSCOs does not overlap or coincide with any other administrative structures in the Army. As a result, much of the matching entailed manual inspection of lists of units to determine

their allocation to a specific jurisdiction. The lack of fit between the PSCO jurisdictions and other administrative structures, especially the Army's computer network, puts the Army's survey program at a serious disadvantage. The capability to select samples centrally and monitor survey administration would enhance this program. A more systematic interface of the PSCOs with the local computer networks would also provide the Army with the capability for better monitoring of samples selected at the local level.

Once the samples were selected, assigning individuals to survey administration units and obtaining addresses for those units was straightforward (with the exception described above). Minor problems were encountered, however, in the production of sample rosters. To simplify distribution of questionnaires in the field, we assumed that rosters would be produced in alphabetical order. Unfortunately, the Services do not utilize standard formats for name entry on their files, nor is there complete consistency within a given Service. We assumed that errors remaining in the rosters after DMDC reformatting would have no impact on field procedures.

The experience from the sample design and selection for the 1978 DoD survey has definite implications for subsequent survey efforts in OSD. First, sample design and selection procedures have to be undertaken simultaneously, with feedback between the two. Second, considerable time and resources have to be allocated to these activities, so that surveys are conducted in a timely fashion; we underestimated both time and resources by a factor of two for this survey. Finally, we would like to see the development in the Army, Navy, and Marine Corps of a sampling capability that interfaces with central personnel files and a survey capability that is integrated into the personnel organization, i.e., a system similar to that of the Air Force. Access to such a capability would make routine, professional-level data collection possible at the OSD level.